Wang Laboratories 2200 Series

MANAGEMENT SUMMARY

Wang Laboratories' 2200 Series product line currently consists of the 2200VP, 2200MVP, 2200LVP and 2200SVP processors, all of which are multi-user or multi-user upgradeable systems. The 2200 Series product line also includes the 2200 PCS-III, a packaged system which is single-user oriented.

The CPU and floppy disk drive are packaged together with appropriate cables and a cabinet to produce an integrated system. The 2200 PCS-III includes the CPU, CRT, keyboard and single-sided double density minidiskette drive in a standard CRT-size enclosure as well as an optional disk multiplexer controller. The number of peripherals that can be attached to a given system depends on the number of I/O slots that are available, with most peripherals requiring one slot. In all 2200 Series CPUs, highly efficient use of memory is achieved through the use of separate control memory to store the BASIC-2 interpreter and operating system.

Wang began marketing the original 2200 Series in the Spring of 1973. The Model 2200VP processor, announced in September 1976, introduced the second generation 2200 Series CPU design with enhancements such as a maximum of 64K bytes of user memory, faster execution time, wider internal data paths, faster memory, error checking, and the BASIC-2 programming language.

The Model 2200MVP processor was the first multi-user processor that Wang offered for the 2200 Series. The 2200MVP can support up to twelve interactive terminals and up to sixteen concurrent jobs. Each terminal has access to a foreground and multiple background partitions. CPU-intensive jobs such as printing and sorting can be processed in the background while ➢

A series of five minicomputer systems that offer both batch and interactive communications capabilities.

Emulation packages are provided for standard Teletype communications; IBM 2741 emulation; IBM 2780, 3780, and 3741 batch terminal communications; and IBM 3270 interactive communications.

A basic 2200PCS-III with 32K bytes of user memory, a CRT display, and a minidiskette drive is priced at $6,500. Prices range upward to $21,000 for a 2200MVP processor with 256K bytes of user memory, excluding peripherals. Leases and rental plans are also available.

CHARACTERISTICS

VENDOR: Wang Laboratories, Inc., One Industrial Avenue, Lowell, Massachusetts 01851. Telephone (617) 459-5000.

DATE OF ANNOUNCEMENT: 2200VP, 11/76; 2200MVP, 3/77; 2200SVP, 4/80; 2200LVP, 4/80; PCS-III, 4/80.

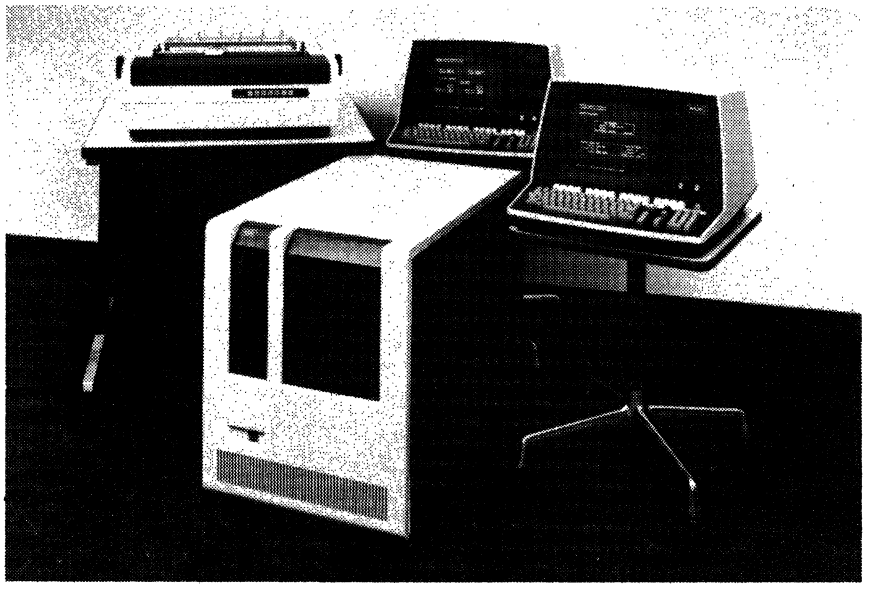
DATE OF FIRST DELIVERY: 2200VP, 12/75; 2200MVP, 1/78; 2200LVP, 6/80; 2200SVP, 9/80; PCS-III, 10/80.

NUMBER INSTALLED TO DATE: 50,000 2200 Series systems.

SERVICED BY: Wang Laboratories.

CONFIGURATION

The 2200 Series currently consists of five models: ➢



Wang's 2200LVP uses a one-megabyte dual-sided, double-density diskette and a 2-, 4-, or 8-megabyte fixed disk. User memory can be expanded from 32K bytes to 128K bytes. The system can support from one to four terminals and can perform multiple functions concurrently with no sacrifice in response time.

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interactive applications programs or program development tasks are executed in the foreground.

The Model 2200LVP central processing unit is a high-performance processor which can support as many as four users simultaneously and provide computing speed and power unavailable on other machines in its price range. The LVP employs a user-defined, fixed-partition memory configuration to extend multiprogramming capabilities to system users.

The 2200LVP utilizes two new disk drive units, featuring the latest advances in hardware design. The soft-sectored, dual-sided double density diskette can store approximately one megabyte of data and quickly provide backup. A fixed-only rigid disk drive utilizes new 8" Winchester technology. Both the DSDD diskette and the fixed-disk drive are integrated into the compact system housing.

The Model 2200SVP is a compact single-user, high-performance processor. Programmable in Wang's BASIC-2 language, the 2200SVP is designed to meet the requirements of both the first-time user and large corporations. The 2200SVP incorporates the DSDD diskettes or an optional fixed-only rigid disk. The 2200 SVP, LVP, MVP, and VP are software-compatible.

The 2200 PCS-III is a computer system providing data entry and business/scientific calculation capabilities at either local or remote sites. Its compact design makes portability an added feature. Contained within the PCS-III is a central processor with a standard 32K of random access user memory. Since only 700 bytes are utilized for system overhead, all remaining memory is accessible to the user. The PCS-III incorporates within the single compact unit a 9-inch CRT, a single-sided double density 5¼ inch diskette, and a BASIC language keyboard for text entry.

All systems manufactured by Wang are modular. They can be expanded from minimal processors to larger systems simply by installing additional memory plus the desired peripheral devices such as disk and diskette drives, printers, plotters, magnetic tape drives, telecommunications devices, and terminals.

Communications capabilities are provided by a combination of hardware and software options. Support is provided for emulation of Teletype operations and the following IBM equipment: 2741, 2780 EBCDIC, 2780 ASCII, 2780 multipoint, 3780, 3275, and 3271-2. A remote control and maintenance software package is available that permits diagnostics to be performed by one 2200 system on another remote 2200 system. Another package is available that includes software and interface hardware to support the transfer of word processing documents between a 2200 system and a Wang OIS, WPS, or VS system.

Simplicity of programming is a significant 2200 Series feature. A BASIC-2 language interpreter, which resides in

2200VP—A single-workstation system that provides 32K to 64K bytes of user memory and 9 I/O slots for attachment of peripheral devices.

2200MVP—A multi-workstation system that provides 32K to 256K bytes of user memory and 9 I/O slots for attachment of peripheral devices. Up to 12 workstations can be supported.

2200LVP—A multi-workstation system that provides 32K to 128K bytes of user memory, an integral double-sided/double-density floppy disk drive, and 3 or 9 I/O slots for attachment of additional peripheral devices. Up to 4 workstations can be supported.

2200SVP—A single-workstation system that provides 32K to 64K bytes of user memory, and an integral single-sided/double-density, floppy disk drive.

2200PCS-III—A single-workstation desktop system that provides 32K bytes of user memory, an integral mini-floppy disk drive, and a keyboard/display.

All Wang 2200 Series systems use microprogram-controlled central processing units. Processor cycle time is 600 nanoseconds on 2200VP, 2200MVP, 2200SVP, 2200LVP; 1.6 microseconds on the PCS-III. Parity checking in both data memory and control memory is standard on all 2200 Series systems except the 2200 PCS-III. The programming language, BASIC, is integral to the CPU. The interpreter is loaded from disk on the 2200VP, 2200MVP, 2200SVP, and 2200LVP; on the 2200 PCS-III, the interpreter is a firmware package permanently in ROM.

The 2200VP and MVP CPUs contain slots for nine I/O controllers. The 2200LVP contains either three or nine slots for I/O controllers. Each I/O controller can support one or more devices. The number of devices that can be plugged into the system is limited only by the number of I/O slots available. The SVP can support two printers, one terminal, and one telecommunications device. Most peripherals have independent microprocessor-based controllers with extensive buffering capabilities, allowing overlapped I/O capabilities. True multi-processing capabilities exist within the 2200 Series product line. Both the MVP and LVP can execute 16 concurrent jobs. All 2200 Series processors have disk multiplexing capabilities, allowing the sharing of processing between multiple processors.

The 2200VP, SVP, and PCS-III will each support one workstation; the 2200LVP will support 4; and the 2200MVP will support twelve.

The 2200MVP and 2200VP can support 480 megabytes of disk storage (six 80-megabyte drives). The 2200SVP can support over one megabyte of single-sided, double-density diskette storage and over four megabytes of fixed disk storage (500,000 bytes of diskette storage is standard). The 2200LVP can support one megabyte of double-sided, double-density diskette storage and up to eight megabytes of fixed disk storage. The PCS-III single-sided, double-density diskette drive contains 140K bytes, and a second drive can be added.

Nine-track tape drives which record at 800 or 1600 bpi are available with controller. A drive-only model is available with 800 bpi density only.

Printers are available with print speeds ranging from 30 cps to 600 lpm.

TRANSMISSION SPECIFICATIONS

The following optional communications features are available for the 2200 Series.

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control memory, is included in the 2200 Series product line. The interpreter is loaded into RAM from a storage device. The BASIC-2 language was developed because it is easy to learn, allowing for ready implementation of programs by the user. An extensive operating system is not required because BASIC-2 language statements, when executed, invoke a large number of functions, providing system and input/output control. The Wang systems are interpreter-based, permitting the user to program directly in BASIC-2 without the need for intermediate compiling or assembling.

The major source of software for the 2200 Series is Wang's independent software vendor network. This network has created literally thousands of applications that can be run on the 2200 Series product line. Applications have been created for diversified fields, both commercial and scientific. Many software packages written by the software network are cross-licensed between vendors to allow for national and regional coverage. Wang sales personnel can coordinate and provide liaison between the user and those software houses which have developed 2200 Series applications.

Wang also has developed and markets its own software packages, including the five available General Business System (GBS) accounting modules: Module 1 includes invoicing, accounts receivable, sales analysis, and inventory capabilities; Module 2 consists of order entry and inventory reporting; Module 3 consists of accounts payable and general ledger; Module 4 includes payroll; Module 5 consists of bill of materials. In addition, there is an inventory management package that is compatible with GBS. These modules can be run on a minimum system consisting of any 2200 Series CPU with 32K bytes of memory and a 2231W printer. One version runs on a 5- or 10-million-byte disk with a single diskette, while a second version runs on a triple-diskette system.

The General Business Systems modules are installed and maintained by software vendors located in each of the Wang districts throughout the United States and Canada. The modules are provided to the software vendors through a license fee arrangement from Wang. Installation prices charged by the software vendor are directly related to the complexity of the installation. Thus, no prices for the GBS software are given at the end of this report.

IDEAS (Inquiry Data Entry Access System) is a development tool used to create and maintain data files, to generate sophisticated screen formats, to solicit and validate operator-entered data, and to produce complex reports. IDEAS produces highly modularized BASIC code which can be easily modified through the use of resident system subroutines.

Additional specialized applications, which are problem-oriented and not as generalized as the modules, are available from Wang Laboratories and independent

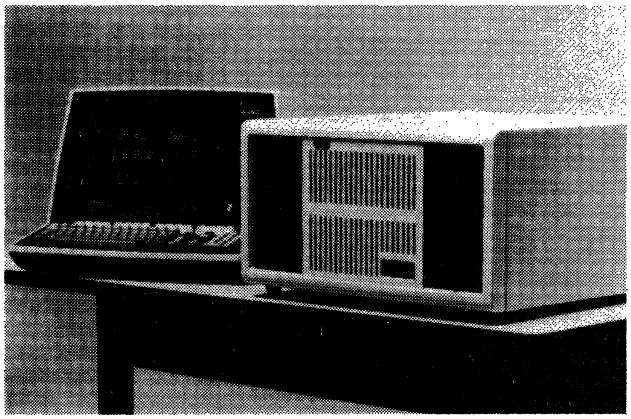
2207A ASYNCHRONOUS INTERFACE CONTROLLER: The 2207A provides an RS-232-C interface between a 2200VP CPU and any Teletype-compatible peripheral, terminal, or laboratory instrumentation device. Two switch-selectable operating modes are provided: eight-bit transparent mode or seven-bit even-parity mode. Five data rates are also switch-selectable from 110 to 1200 bits per second.

2227B ASYNCHRONOUS TELECOMMUNICATIONS CONTROLLER: The 2227B operates in either full- or half-duplex mode and has a switch-selectable character length (five to eight bits), stop bits (one or two), and parity (odd, even, or none). Any one of the following rates can be set via the initializing communication control vector; 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, or 9600 bps. With this controller, a system can be programmed to function like a variety of asynchronous terminals (Teletype, IBM 2741 typewriter terminal, Wang word processing terminal) or to communicate with another comparably equipped system. The unit can operate at switch-selectable data rates of 110, 150, or 300 bits per second through a Bell 103A or equivalent modem and can operate at 1200 bps through a Bell 202C when connected to a switched line. The unit can also operate at 1800 bps when directly connected to a dedicated line. All Wang processors support the 2227B through the $GIO instructions and utility software packages. The 2227N null modem adapter is used when connecting to a dedicated line.

2228B BISYNCHRONOUS COMMUNICATIONS CONTROLLER: The 2228B contains a microprocessor, ROM, RAM, and I/O buffers to execute a communications program. Currently three emulator programs are available from Wang: IBM 2780 EBCDIC, 2780 ASCII, 2780 multipoint, IBM 3780, and IBM 3741. One program is included in the price of the controller, and other emulator programs may be ordered for $200 each. The following modems can be used: Bell 201A (2000 bps), Bell 201C (2400 bps), or Bell 208B (4800 bps).

2228C BISYNCHRONOUS COMMUNICATIONS CONTROLLER: The 2228C can support Wang's 3275 bisynchronous emulator in addition to all of the software supported by the 2228B.

2228D BISYNCHRONOUS COMMUNICATIONS CONTROLLER: The 2228D supports the 22TC-3271 emulator for MVP and LVP systems only. Using this emulator, up to 3 of the 7 CRT workstations and up to 4 printers of an LVP



The 2200SVP is one of the newest additions to Wang's 2200 series. A single-user system, the 2200SVP is programmable in Wang's BASIC-2 language, offers memory expansion to 64K bytes, and includes a newly-designed 500K single-sided, double-density diskette. An additional 500K diskette can be added.

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software houses. Such applications include an insurance package, a patient billing package, a mortgage management package, a distributors inventory package, plotter utilities, and a civil engineering surveying package.

The 2200 Series product line competes directly with the IBM Series 1 systems and System 32, the Data General CS Series, and the DEC Datasystem line. The 2200LVP competes with the Texas Instrument DS990, model 2 among others. The 2200 PCS-III Personal Computer System and the 2200SVP are active in the competitive "table-top" computer market with IBM's 5120, DEC's Datasystem 150, and the Hewlett Packard 9845.

Wang Laboratories' financial picture continues to show strong improvement. Sales of the company's products increased by 69 percent from fiscal 1979 to fiscal 1980—to $543 million—and net income increased by 82 percent. With an installed base exceeding 40,000, Wang is ranked as the number 2 worldwide supplier of small business systems.

USER REACTION

In our 1980 user survey, Datapro received thirty responses from users of Wang's 2200 Series systems. Eight users had a total of forty-eight 2200VP's, and the other twenty-two users had thirty-four 2200MVP's. Geographically, the thirty users almost blanket the United States, from Massachusetts in the East to Hawaii in the West, with every section in between represented.

The users included four developers of software, five service bureaus, three manufacturers, a savings and loan, an office of a very large soup company, a CPA firm, a printing company, a trust company, a large commercial farm, a contractor, an elevator company, and a senior high school.

Accounting was by far the most reported application, with payroll/personnel the runner-up. Other applications reported were transaction processing, retail, insurance, engineering/scientific, distributed processing, banking/finance, word processing, manufacturing, government, education, and construction. In-house personnel had been the main source of applications programs for twenty-two of the users. Other leading sources were programs from the manufacturer, contract programming, and proprietary software packages. BASIC was the only programming language in use.

Sixty-four of the systems had been purchased; eleven were being rented; and the rest were leased. The average life of the 2200VP's was thirty-three months, and the average 2200MVP had been in use for sixteen months. The average 2200VP had two workstations attached, while the average 2200MVP had 2.6 workstations. Two of the 2200VP users plan to replace their systems in 1980 with equipment from a different manufacturer; the other twenty-eight users have no plans to replace their systems this year.

system, or up to 7 of the 12 CRT workstations and up to 4 printers on an MVP system, may operate as IBM 3277-2 displays and 3288-2 printers under control of the 2200 processor, which operates as a 3271-2 controller. The 2228D Controller may be specified with either an RS-232-C/V.24 or RS-449 interface.

2250 PARALLEL INTERFACE CONTROLLER: The 2250 provides an eight-bit program-controlled parallel input and output interface to similar peripherals. The unit can support data rates up to 10K characters per second. The normal operating mode for the 2250 is to pass seven-bit ASCII characters with the eighth bit set to logical zero. The 2250 is supported by the standard BASIC interpreter on the 2200VP.

2252A BCD INPUT INTERFACE: The 2252A is used to interface external devices such as digital voltmeters, digital panel meters, counters, etc., to 2200 systems. Inputs to the 2252A can be up to ten BCD digits or up to forty bits of binary information. Data can be either fixed or floating point. The logic interface is TTL/DTL-compatible.

2254 IEEE-488 INTERFACE: This interface requires one I/O slot in the CPU and transfers data in byte-serial and bit-parallel modes, along with BUS control and management information. Devices connected to the interface may be any one of the following: Listener, Talker, Talker/Listener, or Controller. The 2254 can be field-settable to operate as a controller or non-controller. Up to fifteen devices can be connected.

MODEL 2236MXD TERMINAL PROCESSOR: Provides the means to support as many as four Model 2236 interactive terminals per each 2236MXD. Three 2236MXD may be used in conjunction with the 2200MVP; only one MXD may be used with the 2200LVP. The 2236MXD serves as a front-end processor between terminals and the main CPU. Other specifications are identical to those of the MXC.

OPTION 62B COMMUNICATIONS CONTROLLER: Allows Wang's minidiskette-based PCS-III system to function as an "intelligent" distributed processing terminal, using binary synchronous communications protocols in turnkey emulation utilities packages for the IBM 2780, 3780, or 3741 and asynchronous emulation packages for Teletype and IBM 2741 procedures. A software package for any one device type is provided at no additional charge with each Option 62B controller.

SOFTWARE

OPERATING SYSTEM: None (see next paragraph).

LANGUAGES: All programming is done in BASIC or BASIC-2. A BASIC-2 language interpreter which resides in control memory is embedded in the 2200 Series processors. The interpreter is loaded into RAM from a storage device. The BASIC-2 language was developed because it is easy to learn, allowing for ready implementation of programs by the user. An extensive operating system is not required because BASIC-2 language statements, when executed, invoke a large number of functions, providing system and input/output control.

In general, the user is offered a choice of two operating modes, program and immediate. In the immediate mode, single and multiple BASIC-2 statements are executed as on-line instructions. This mode can be implemented without altering existing programs. For example, the operator can use the 2200 Series system to perform arithmetic calculations during an interactive program without disrupting program execution.

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The users' ratings are tabulated below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	23	6	0	1	3.7
Reliability of mainframe	18	10	2	0	3.5
Reliability of peripherals	8	16	4	2	3.0
Maintenance service:					
Responsiveness	8	15	3	3	3.0
Effectiveness	9	12	7	2	2.9
Technical support:					
Trouble-shooting	5	14	8	1	2.8
Education	4	10	8	7	2.4
Documentation	4	11	10	4	2.5
Manufacturer's software:					
Operating system	11	11	1	3	3.2
Compilers and assemblers	10	7	0	1	3.4
Applications programs	6	7	6	3	2.7
Ease of programming	16	10	1	1	3.5
Ease of conversion	11	7	4	2	3.1
Overall satisfaction	14	14	1	1	3.4

*Weighted Average on a scale of 4.0 for Excellent.

Only thirteen of the thirty users indicated that they had experienced any significant problems with their systems, and only three failed to report any significant advantages. The highest-ranking advantage was that the systems are easy to expand or reconfigure. The next most reported advantage was that the users are happy with the systems' response time. Other advantages reported, more or less in sequence, were that the programs and data are compatible with other systems, that productivity aids help to keep programming costs down, that terminals and peripherals are compatible, that the systems are power/energy efficient, that the database language is effective, and that delivery and/or installation of equipment and software was ahead of schedule.

No one problem seemed to stand out above the others, and the problems which had been encountered were reported by very few users. Four users felt that the system proposed by the vendor had proven to be too small; three said that the delivery and/or installation of the equipment was late; six found that their costs had exceeded expectations; three said that the vendor did not provide all the promised software or support; two felt that the vendor's enhancements and changes to hardware and software are hard to keep up with; and four said that the equipment was excessively noisy.

Individual comments included, "Wang hardware has excellent price/performance advantage over the other systems we evaluated (NCR 8200, Burroughs B800, Qantel)" and ". . . the recently introduced IDEAS package is a fine set of programs which perform most file management operations without the need for any programming."

One user, a service bureau, added the following to the survey form:

"The Wang 2200 [an MVP, in this case] system is modular and expansion is extremely easy. We have just recently incorporated the use of Wang's new 2280

Programming features in the program mode include the use of four types of variables, with each type having as many as 286 names available. These variable types are numeric, numeric array, string and string array. One- and two-dimensional numeric or arithmetic string arrays can be used.

User-defined special functions are subroutines, program functions, or character strings stored in memory which can be accessed by special function keys. Sixteen keys are available; each key controls two special functions, for a total of 32 special functions.

Debugging and error diagnostics are standard features available to the user. When an error is made during program entry, a diagnostic error pointer and an error code indicate the portion of the line containing the error along with a code referencing the type of error. In the programmable trace function, either a CRT display or a printout is made whenever a program transfer occurs or when a program variable receives a new value. Another debugging aid is the halt/step operation (a key on the keyboard): one program statement is displayed and executed each time the halt/step key is pressed. This aid permits a line-by-line program analysis.

The useful program editing features are statement renumbering, line correction, and line insertion. Whole programs or program segments can be renumbered, with new statement number increments as defined by the user. Line corrections can be made in three ways: backspacing through a line to the point of error and then retyping the corrected line from that point, deleting the entire line by re-entering the line number and striking the return key, or replacing the line by re-entering the line number and keying in the correct program statement.

Program loading can be accomplished from the keyboard or, as in the case of chained program operation, under program control. Entire programs or portions of programs can be saved on disk. Saved programs are identified by alphanumeric name from disk storage. A special program protection command, SAVE P, when included in the program, prevents listing or altering of the program. On all 2200 Series systems except the PCS-III, programs can be scrambled to ensure even greater security.

INTEGRATED SUPPORT SYSTEMS: ISS has two functions. First, it provides a complete selection of stand-alone utilities, a file access management system, and programming aids; and second, it integrated these system elements with one another and with user software by means of a common access procedure. ISS is supplied by Wang on four functionally organized diskettes. These diskettes can be converted to any Wang standard storage device. One diskette provides system support utilities, one provides the KFAM file access management system, one provides a sort software system, and the fourth provides programming aids. The software is also available on a dual-sided double-density diskette.

The utilities are stand-alone routines designed to perform tasks frequently required in a disk-based data processing system: Copy/Verify, Sort Disk Catalog, Disk Dump, Compression (which reduces the size of source program files by eliminating spaces, remark lines, and nonessential line numbers), and Decompress (which copies program files and breaks up all multi-statement lines by assigning a unique line number to each BASIC statement). Others include List/Cross Reference, List, Reconstruct Catalog Index, and Create Reference File.

The KFAM (Keyed File Access Method) is a software system designed to produce, search, and maintain an index

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TABLE 1. 2200 Series Peripherals

DEVICE	DESCRIPTION AND SPEED
DISPLAYS/KEYBOARDS	
2236DE	Interactive CRT terminal/workstation; alphanumeric keyboard, 10-key numeric keypad, special function keys, 24 lines of 80 characters; plug-compatible with any standard Wang printer
2210A	CRT display; 12-inch, 16 lines of 64 characters, upper/lower case keyboard, includes minidiskette drive in console, with controller
2210B	Same as 2210A except 24 lines of 80 characters
2226A	CRT display; 12-inch, 16 lines of 64 characters, upper/loewr case keyboard in console, with controller
2226B	Same as 2226A except 24 lines of 80 characters
22D31	Keyboard console only for 12-inch CRT
22D33	Same as 22D31 with single minidiskette drive
DISK/DISKETTE	
2280	Fixed/removable disk drive; 26MB, 53MB, or 80MB; removable disk cartridge and first fixed disk each contain 13.6MB, second and third fixed disks each contain 26MB; data transfer rate is 1.2MB per second; average rotational delay is 83.3 ms; average access time is 38 ms; can be used only with 2200VP, MVP, and LVP, multiplexible with a 2280 MUX Disk Multiplexer
2280 MUX	Disk multiplexer; allows any combination of three 2200VP, MVP, or LVP's to share a Model 2280 disk drive or a pair of 2280's
2260 BC	Fixed/removable disk drive; 2.5MB, 5MB, 10MB, or 20MB; provides one fixed and one removable platter; data transfer rate is 312K bytes per second for 256K-byte blocks; average rotational latency is 12.5 ms; average head positioning time is 20 to 40 ms; can be used only with 2200 VP, MVP, and LVP; disk controller supports one or two drives and requires one I/O slot; multiplexible with a 2230 MX disk multiplexer
2260 C	Same as 2260 BC except controller handles only one drive, and 2260 C cannot be multiplexed
2230 MXA/B	Disk multiplexer; allows sharing of one 2260 BC disk drive among up to four processors; 2230 MXA is required for the first CPU; one 2230 MX/B is required for each additional CPU
2270 A	Diskette subsystem containing one, two, or three 315K-byte drives; 3741-compatible; data transfer rate is 31,000 bytes per second for 256K-byte blocks; average head positioning time is 320 ms; average rotational delay is 80 ms; diskette controller handles up to three drives and requires one I/O slot; can be used only with 2200 VP, MVP, and LVP
2200 PCS-III Minidiskette Drive	One or two 5.25-inch diskette drives each providing 143K bytes of storage; average access time is 180 ms
MAGNETIC TAPE	
2209	9-track, 12.5-ips, 800-bpi, 10.5-inch reels, 10K-bps, with controller
2209A	9-track, 12.5-ips, 1600 bpi, 10.5-inch reels, 20K-bps, with controller
22D09	9-track, 800-bpi, drive only
CARD EQUIPMENT	
2244B	Reader; 80-column, punched card or mark sense; 300 cpm, with controller
22D44	2244B without controller
PAPER TAPE	
2203	Reader; forward or reverse read; 300 cps
PRINTERS/PLOTTERS	
2221W	132-column, 96-character, 9 x 9 dot matrix, 200 cps
2231W-1	112-column, 96-character, 9 x 9 dot matrix, 120 cps
2231W-2	132-column, 96-character, 9 x 9 dot matrix, 120 cps
2231W-3	Graphic CRT accessory matrix printer for 2282
2231W-6	132-column, 70 cps, matrix line printer, high density
2232B	Digital flatbed plotter; 31 x 48 inches, four-quadrant, 0.01-inch steps, with controller
22D32	2232B without controller
2251	40-column, 96-character, 7 x 8 dot matrix, 100 cps
2261W	136-column (68 expanded characters), 10-pitch or 160-column (80 expanded characters), 12-pitch, 96-character, 11 x 9 matrix (10-pitch) or 9 x 9 matrix (12-pitch); 220 lpm independent of pitch; 4 matrix heads, bidirectional, 6 or 8 lines per inch
2263-1	132-column, 64 ASCII characters, chain; 400 lpm
2263-2	132-column, 64 ASCII characters, chain; 600 lpm
2263-3	132-column, 96 ASCII characters, chain; 430 lpm
2272-2	Drum plotter; 16 inches by unlimited inches, 0.01-inch steps, pin-feed platen, digital input, program-selectable three pen holders
2273-1	Band printer, 250 lpm
2273-2	Band printer, 600 lpm
2281W	Wang daisy printer plotter, 30 cps
2282	Graphic CRT only; 12" screen, 800 x 512 addressable locations; 112-character ASCII set, upper/lower, 15 sizes of character
IP41L	Image printer; 18 pages/minute, two paper trays; 10-, 12-, or 15-pitch
OTHER	
22C32	Triple controller; provides support for one 2236DE interactive terminal, one 2200 Series parallel printer, and one 2280, 2260C, or 2270A disk drive

disk drive (80 megabytes) . . . and 4 new 2236DE graphics terminals. The new peripherals were fully functional within an hour after being uncrated and we have encountered absolutely no problems."

Twenty-seven of the users said that they would recommend their system to other users; three said that they would not. Two of those three were responsible for almost all of the low ratings.□

to the records in a disk-based data file. KFAM includes subroutines which are incorporated into user-written application programs. These subroutines perform all the required applications on the index (e.g., random-access search, sequential-access search, adding and deleting records). KFAM also provides the utility programs required to set up new files and provide all necessary file maintenance. KFAM is available in versions to support configurations ranging from a single-CPU system to multiple-CPU/multiple-disk systems.

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Programming aids offer the programmer a variety of subroutines which may be incorporated into application programs. The programming aids subroutines include search catalog index, allocate data file space, free unused sectors, data entry, open/close output, alphanumeric input, etc. Programming aids also include SORT-4, a flexible, free-standing sort routine.

APPLICATIONS PROGRAMS: Wang Laboratories offers 2200 Series applications programs through three groups: the software vendor network; the Wang Users' group; and the Wang in-house software development staff. The major source of software for the 2200 Series product line is Wang's independent software vendor network. Commercial and scientific applications have been created for diversified fields. Many software network-developed packages are cross-licensed between vendors, allowing national and regional access.

Most of the currently available applications programs have been developed by users and software vendors. Wang's in-house software group has produced the utilities, standard subroutines, an extremely comprehensive statistical analysis package, and several accounting packages. Brief descriptions of some Wang-developed and supported packages follow:

General Business Systems Modules: Include packaged programs for invoicing, accounts receivable, sales analysis, order entry, inventory control, accounts payable, and general ledger.

IDEAS: Inquiry Data Entry Access System is an application development tool which can be used to create and maintain data files, generate sophisticated screen formulas, solicit and validate operator-entered data, and produce complex reports.

Statistics/Engineering General Program Library: Includes a wide variety of programs for common problems in statistics (including several regression analyses), civil and sanitary engineering, electrical engineering, chemical engineering, and structural engineering.

General Plotter Utilities: Provide users of digital plotters with full plotting capabilities. These are stand-alone programs which scale, plot, and alphanumerically label rectangular, parametric, or polar equations; bar charts; pie charts; point plots; and line graphs. The user can select either linear, logarithmic, or polar scales for special plots. No technical programming background is necessary to produce graphs.

RCM: Remote Control and Maintenance is a diagnostic tool that allows one 2200 system to take command of another remote 2200 system and to perform diagnostic tests on that system.

COMPONENTS

See Table 1 for a complete list and brief description of all 2200 Series peripherals.

PRICING

The Wang 2200 Series systems are available for purchase, lease, or rental. Most software (i.e., application packages) is separately priced and is available directly from Wang Laboratories and also from independent software houses. Marketing personnel at Wang can assist users in selecting software houses that can meet their particular user needs.

Wang Laboratories, Inc., offers two-, three-, and five-year leases, with separate service contracts mandatory for one year on leased equipment.

Rentals are available either with or without an option to purchase. Rental agreements include full maintenance of the equipment. On rentals with option to purchase, rebates are offered depending on the term of rental (minimum rental terms are three months, with maximum rental for up to 24 months). The amount of rebate applicable to system purchase depends on the particular rental plan agreed upon; ten plans are available. However, the service portions of the rental do not apply to purchase.

The equipment is sold with a 90-day warranty on parts and labor plus a one-year warranty on parts manufactured by Wang Laboratories. Maintenance beyond the 90-day warranty is offered on a contract basis depending on the nature of the equipment.

Initial installation and system testing are performed at no charge. After the initial system installation, a small service charge to cover the cost of maintenance personnel expenses is made for each peripheral device added to the system.

Training is available at the company's training facility in Burlington, Massachusetts. Scheduled five-day courses are given covering system operation, programming, and applications. Users pay for course enrollment plus travel and accommodation expenses incurred during training.

Sales personnel are trained at company headquarters and assigned to over 115 sales offices located throughout the United States. Wang has 300 offices in eighty countries.

Wang Laboratories 2200 Series

EQUIPMENT PRICES

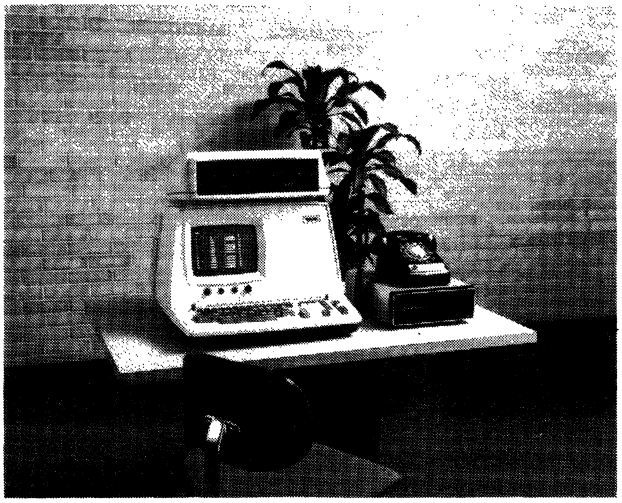
		Purchase Price	Monthly Maint.
SYSTEMS			
2200VP			
2200VP-8	CPU, 9 I/O slots, 32K memory	$ 6,000	$ 70.00
2200VP-16	CPU, 9 I/O slots, 64K memory	8,500	97.00
2200MVP			
2200MVP-8	CPU, 9 I/O slots, 32K memory, extended configuration chassis	9,000	81.00
2200MVP-16	Same with 64K memory	12,000	107.00
2200MVP-32	Same with 128K memory	15,000	172.00
2200MVP-48	Same with 192K memory	18,000	220.00
2200MVP-64	Same with 256K memory	21,000	268.00
2200SVP			
2200SVP-8	CPU, 500K single-sided double-density diskette, 32K memory	6,000	68.00
2200SVP-16	Same with 64K memory	9,000	95.00
2200LVP			
2200LVP-8	CPU, 3 I/O slots, 1-megabyte double-sided double-density diskette, 32K memory, cabinet	8,000	80.00
2200LVP-16	Same with 64K memory	11,000	108.00
2200LVP-32	Same with 128K memory	14,000	170.00
PCS-III			
2200PCS-III-8	Personal Computing System, 9-inch CRT (64 x 16, upper/lower case), 140K single-sided double-density diskette, 32K memory	6,500	88.00
MEMORY			
V3264	32K to 64K upgrade (for 2200VP, 2200MVP, 2200SVP, and 2200 LVP)	3,000	28.00
V32128	32K to 128K upgrade (for 2200MVP and 2200LVP)	8,000	90.00
V32192	32K to 192K upgrade (for 2200MVP)	11,000	139.00
V32256	32K to 256K upgrade (for 2200MVP)	16,000	187.00
V64128	64K to 128K upgrade (for 2200MVP and 2200LVP)	5,000	62.00
V64192	64K to 192K upgrade (for 2200MVP)	8,000	113.00
V64256	64K to 256K upgrade (for 2200MVP)	13,000	161.00
MASS STORAGE			
2260-1/4	1.25-megabyte fixed and 1.25-megabyte removable disk drive with 22C12 controller and stand	7,200	108.00
2260-1/2	2.5-megabyte fixed and 2.5-megabyte removable disk drive with 22C12 controller and stand	9,200	108.00
2260C	5-megabyte fixed and 5-megabyte removable disk drive with 22C12 controller and stand	11,200	108.00
2260C-2	Dual 5-megabyte fixed and 5-megabyte removable disk drives with 22C12 controller and stands	18,400	173.00
2260BC-1/4	1.25-megabyte fixed and 1.25-megabyte removable disk drive with 22C13 controller and stand	8,000	108.00
2260BC-1/2	2.5-megabyte fixed and 2.5-megabyte removable disk drive with 22C13 controller and stand	10,000	108.00
2260BC	5-megabyte fixed and 5-megabyte removable disk drive with 22C13 controller and stand	12,000	108.00
2260BC-2	Dual 5-megabyte fixed and 5-megabyte removable disk drives with 22C13 controller and stand	19,000	173.00
2270-1	1/4-megabyte single removable diskette drive only	3,200	36.00
2270-2	1/2-megabyte dual removable diskette drives only	4,700	49.00
2270-3	3/4-megabyte triple removable diskette drives only	6,200	70.00
2270A-1	1/4-megabyte Wang/3740 diskette, single removable diskette drive only	3,600	33.00
2270A-2	1/2-megabyte Wang/3740 diskette, dual removable diskette drives only	5,100	49.00
2270A-3	3/4-megabyte Wang/3740 diskette, triple removable diskette drives only	6,600	65.00
2280-1	13.4-megabyte fixed and 13.4-megabyte removable disk drive with 22C14 disk processing unit and controller	19,000	206.00
2280-2	40.2-megabyte fixed and 13.4-megabyte removable disk drive with 22C14 disk processing unit and controller	20,000	216.00
2280-3	67-megabyte fixed and 13.4-megabyte removable disk drive with 22C14 disk processing unit and controller	21,000	227.00
2280N-1	13.4-megabyte fixed and 13.4-megabyte removable disk drive only	17,000	184.00
2280N-2	40.2-megabyte fixed and 13.4-megabyte removable disk drive only	18,000	195.00
2280N-3	67-megabyte fixed and 13.4-megabyte removable disk drive only	19,000	206.00
22C03	Disk/diskette controller	200	2.50
2297	Optional stand for 2260C series drives	250	N/C
OP-103	Additional single-sided, double-density minidiskette drive for PCS-III	1,000	9.00
MAGNETIC TAPE			
2209	Magnetic tape drive, 9-track, 800-bpi, with controller	10,400	98.00
22D09	9-track, 800-bpi drive only	10,000	96.00
2209A	Magnetic tape drive, 9-track, 1600-bpi, with controller	15,000	119.00
2250	8-bit parallel I/O interface controller	400	2.50

Wang Laboratories 2200 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
CARD EQUIPMENT			
2244B	Hopper-feed mark sense/punched card reader with controller, 300 cpm	6,500	81.00
22D44	Card reader only	5,500	69.00
22C06B	Card reader controller	1,000	13.00
PRINTERS/PLOTTERS			
All printers must be attached to the 22C02 controller, directly to the 2236DE interactive terminal, or to the 22C11 dual controller (print plus diskette) or the 22C32 triple controller for diskette, printer, and 2236DE.			
2221W	Matrix printer with stand; 132 col., 200 cps, 10-pitch	5,000	60.00
2231W-1	Matrix printer; 112 col., 120 cps, 10-pitch	2,900	35.00
2231W-2	Matrix printer; 132 col., 120 cps, 12-pitch	3,200	35.00
2231W-3	2282 graphic CRT accessory matrix printer	3,800	35.00
2231W-6	Matrix line printer, high density, 132 col., 70 cps	3,300	35.00
2232B	Digital flatbed plotter, 31" x 48", with controller	8,000	62.00
22D32	Plotter only	7,800	60.00
22C01	Output writer/plotter controller	200	2.50
2251	Line printer; 40 col., 100 cps	1,200	14.00
2261W	Matrix line printer; 220 lpm, dual pitch	7,000	75.00
2263-1	Line printer; 400 lpm, 64 char.	14,500	155.00
2263-2	Line printer; 600 lpm, 64 char.	16,000	168.00
2263-3	Line printer; 430 lpm, 96 char.	17,000	180.00
2272-2	Drum plotter with three pens	3,200	35.00
2273-1	Band printer; 250 lpm	8,500	87.00
2273-2	Band printer; 600 lpm	12,000	124.00
2281W	Wang daisy printer/plotter, 30 cps	4,500	44.00
OP-123	Monodirectional forms tractor option for 2281W	250	N/C
BFT-1	Bidirectional forms tractor for 2281W; necessary for plotting on 2281W	300	N/C
2282	Graphic CRT only; 12" screen; 112 upper/lower ASCII characters	3,600	19.00
IP41L	Image printer; 18 pages/minute; 10-, 12-, or 15-pitch	32,000	453.00
22C02	Printer/drum plotter controller	200	2.50
22C11	Dual controller, printer/drum plotter and diskette	300	3.50
22C32	Triple controller for diskette, printer, and one 2236DE interactive terminal	1,000	6.00
2211M	Line printer multiplexer (maximum 4 CPU and 1 printer)	1,000	13.00
2295	2231W printer stand	250	N/C
TERMINALS			
2236DE	Interactive terminal; CRT/keyboard, 24 x 80, 10-key pad, function keys	2,700	20.00
2236MXD	4-port terminal multiplexer for 2236DE	1,200	10.00
2210A	12" CRT; 64 x 16, upper/lower case keyboard with single minidiskette drive and controller	3,800	27.00
2210B	12" CRT; 80 x 24, upper/lower case keyboard with single minidiskette drive and controller	4,200	33.00
2226A	12" CRT; 64 x 16, upper/lower case keyboard with controller	2,200	12.00
2226B	12" CRT; 80 x 24, upper/lower case keyboard with controller	2,600	18.00
22D31	12" CRT; keyboard console only	1,200	6.00
22D33	12" CRT; keyboard console with single minidiskette drive	2,800	21.00
22C31	Triple controller for disk/diskette, keyboard, line printer	400	2.50
22C33	80 x 24 upper/lower case CRT controller	1,000	10.00
22C34	64 x 16 upper/lower case CRT controller	600	3.50
TERMINAL OPTIONS			
OP-31	Audio signal for 2210, 2226	200	2.00
OP-32	Keyboard clicker for 2210, 2226	80	N/C
OP-33	80 x 24 upper/lower case CRT controller	400	6.00
OP-101	Additional minidiskette drive for 2210 only	1,000	9.00
I/O INTERFACES			
2207A	I/O interface controller, RS-232C, selectable bps	600	3.50
2227B	Buffered asynchronous telecommunications controller	750	17.00
2227N	Null modem	50	N/C
2228B	Bisynchronous communications controller	1,500	17.00
2228C	Bisynchronous communications for IBM 3275 emulation	1,700	19.00
2228N	Null modem	50	N/C
I/O INTERFACE OPTIONS FOR 2200SVP			
OP27B	Buffered asynchronous telecommunications controller	750	19.00
OP28B	Bisynchronous communications controller	1,500	19.00
OP28C	Bisynchronous communications controller for IBM 3275 emulation	1,700	22.00
I/O INTERFACE OPTION FOR PCS-III			
OP-62B	Bisynchronous communications option	1,500	17.00

Wang Laboratories PCS-II



The PCS-II shown above has an independent processor to handle the communications line; two Minidiskette Drives sit atop the display unit. The compact system can function as a terminal or as a data processor.

A programmable terminal capable of functioning as a stand-alone processor for small business applications, as an intelligent terminal in larger networks, or as a combination of both.

The basic PCS-II includes a microprocessor with up to 32K bytes of solid-state memory, a 64x16 video display unit, one or two minidiskette drives (89,600 bytes of storage each), and a microprogrammed communications controller capable of handling ASCII, EBCDIC, BSC, or Burroughs Basic Mode protocols.

A PCS-II equipped with 16K bytes of RAM and a BSC controller is priced at $6,700 or can be rented on a five-year lease for approximately $165 per month. A maintenance contract for purchased equipment would cost about $75 per month. On leased equipment, maintenance is included.

MANAGEMENT SUMMARY

Wang's Personal Computer System II (PCS-II) is a hybrid equally usable as an intelligent terminal and as a small business computer. This capability is implemented by two minidiskette drives that provide on-line access to a total of 179,200 bytes of random mass storage contained on two five-inch floppy disks.

A separate microprocessor is used for handling the communications interface. This not only makes the function transparent to the user, but also offers operational flexibility beyond that indicated by the interface name. For instance, the Bisynchronous Communications Controller with the BSC program loaded will handle BSC lines, but with the Asynchronous program loaded will handle Teletype or IBM 2741 protocol. Support of other protocols could easily be programmed. The Asynchronous Controller, half the price of the Bisynchronous Controller, cannot support BSC protocol because it does not have sufficient RAM to contain the BSC program.

Since the communications controller microprocessor operates independently of the central processor, data entry can be in progress concurrent with data transmission, given the appropriate software support. Timing and volume consideration of the specific applications would determine the advisability of concurrent operations.

For time-critical I/O operations, PCS's BASIC language provides the capability to code such operations in time-efficient, absolute-like code. However, for typical applications, such considerations are user-transparent. For the user employing the terminal for data entry, and not wishing to do his own programming, Wang supplies ➢

CHARACTERISTICS

VENDOR: Wang Laboratories, Inc., One Industrial Avenue, Lowell, Massachusetts 01851. Telephone (617) 851-4111.

DATE OF ANNOUNCEMENT: March 1977.

DATE OF FIRST DELIVERY: March 1977.

NUMBER DELIVERED TO DATE: Over 250.

SERVICED BY: Wang Laboratories, Inc.

CONFIGURATION

The Personal Computer System-II (PCS-II) is a desktop programmable terminal featuring Minidiskette Drives for random access mass storage and an optional, independent microprogrammed communications controller. The latter permits the terminal to emulate the protocols of the IBM 2780, 3780, 3741, and 2741 on a user-transparent basis.

The basic PCS-II includes:

- **A self-contained version of the Wang 2200T processor.**
- **8K bytes of random access memory (RAM).**
- **A read-only memory (ROM) coded with the BASIC interpreter and the operating system.**
- **A 9-inch (64x16) CRT.**
- **A keyboard.**
- **One Minidiskette Drive.**
- **A Telecommunications Connector.** ➢

Wang Laboratories PCS-II

EASYFORM, a software package to drive the terminal as a data entry device.

Wang is one of several terminal vendors that offers turnkey systems, hardware and special purpose application software for a single price.

Wang would not identify any users for Datapro, and we were unable to find any; so, we could not check on user reaction.□

- Provision for attachment of an Auxiliary CRT.
- Two Printer/Plotter Connectors.
- A spare EIA connector to interface a controller, plotter, or line printer.

The Telecommunications Connector can support attachment of the Bisynchronous Communications Controller, the Asynchronous Communications Controller, the Parallel I/O Controller, or an instrumentation interface. A selection of character and line printers, a single-pen plotter, and a three-pen plotter can be attached to the Printer/Plotter Connectors. One Auxiliary 80x24 CRT can be supported by the Auxiliary CRT connector.

TRANSMISSION SPECIFICATIONS

One of three communications controllers or an instrumentation interface can be attached to the PCS-II Telecommunications Connector.

The Bisynchronous Communications Controller contains its own microprocessor with a 1K ROM and an 8K RAM. With one of three no-cost Wang-supplied software packages, this controller can emulate the BSC protocol of the IBM 2780, 3780, or 3741. Such configurations permit the PCS-II to function as a workstation to an IBM System 360/370 or other BSC-compatible host computer systems. This controller can also be loaded with a program for Burroughs Basic Mode protocol, which supports asynchronous or synchronous, multipoint (poll/select) transmission.

A version of the same microprocessor, with less RAM, is programmed to handle Teletype and IBM 2741 protocols. This Asynchronous Telecommunications Controller is normally used for interactive communications between a host computer and the PCS-II.

Both the Asynchronous and the Bisynchronous Communications Controllers support EIA RS-232C or CCITT V.24 standards. Asynchronous speeds of up to 9600 bps and synchronous operation at up to 7200 bps are supported. An 8-bit Parallel I/O Controller is also available.

SOFTWARE

User programming is normally performed in Wang Extended BASIC. BASIC statements are entered directly through the keyboard and can be run either as entered (immediate mode) or when required (program mode). BASIC statements resident in the RAM are operated upon, or compiled, by the BASIC Interpreter that is permanently resident in the 42.5K-byte ROM along with the operating system. The interpreted instructions are executed by the processor while the next statement is simultaneously being interpreted. BASIC has a repertoire of 132 statements, 99 error codes, and 13 commands. The commands give the user keyboard communication with the Basic Interpreter. BASIC can be commanded to run a program, clear memory, list a program, etc. The user can make up to 32 subroutines of frequently used functions; these can be invoked when writing Program statements by depressing a single function key. Since BASIC does not require one statement per line, a single 192 character line can contain many statements. In addition to the fundamental statements, BASIC provides statements to handle math matrix, trigonometric and algebraic functions, and alphanumeric sorts. One statement gives the programmer the ability to write I/O statements in an absolute code-like fashion. BASIC will support up to 286 variable names for either simple numeric or alphanumeric variables or arrays. The total number of unique variable names is 1144. An alphanumeric variable can be up to 64 bytes long. The nesting maximum for FOR/NEXT loops and for subroutines is each 45 levels. Arithmetic precision is 13 significant digits. All math functions are performed by a separate floating-point processor.

When using the terminal for data entry, the user can avoid programming altogether by using EASYFORM, a Wang software package. The package facilitates creation of an input prompting form that can be used by the operator when entering data. Up to 10 form layouts, each with up to 50 data fields, can be saved on diskette. Data entered through EASYFORM is stored on disk in the appropriate transmission format.

Wang also markets the PCS-II as part of several turnkey systems that also include the application software. Two such systems are described below.

The Time/Check II system performs time analysis of billable time for attorneys, accountants, advertising agencies, architects, and other professionals. The system can also perform the actual billing function and produce customized mass mailings.

The PCS-II Lifeline system produces customized policy proposals for independent life insurance agents. The system can also perform mass mailing of customized letters.

Other software systems include MINICASH, an accountants work-up system; MINI/SPARK, a simplified inventory and warehouse control system for auto parts dealers; AUTOMATE II, an auto dealers finance, insurance and forms filing system; MINI/MPS, a management planning system for budgeting and modeling of forecasts; and MORTGAGE MANAGEMENT, a system to manage and compute residential/commercial mortgages for thrift institutions.

COMPONENTS

DISPLAY UNIT: The console CRT is a 9 inch (22.9 cm) diagonal unit with 16 lines, each accommodating 64 characters (1024 characters total). Character height and width is 0.125 inches (0.32 cm).

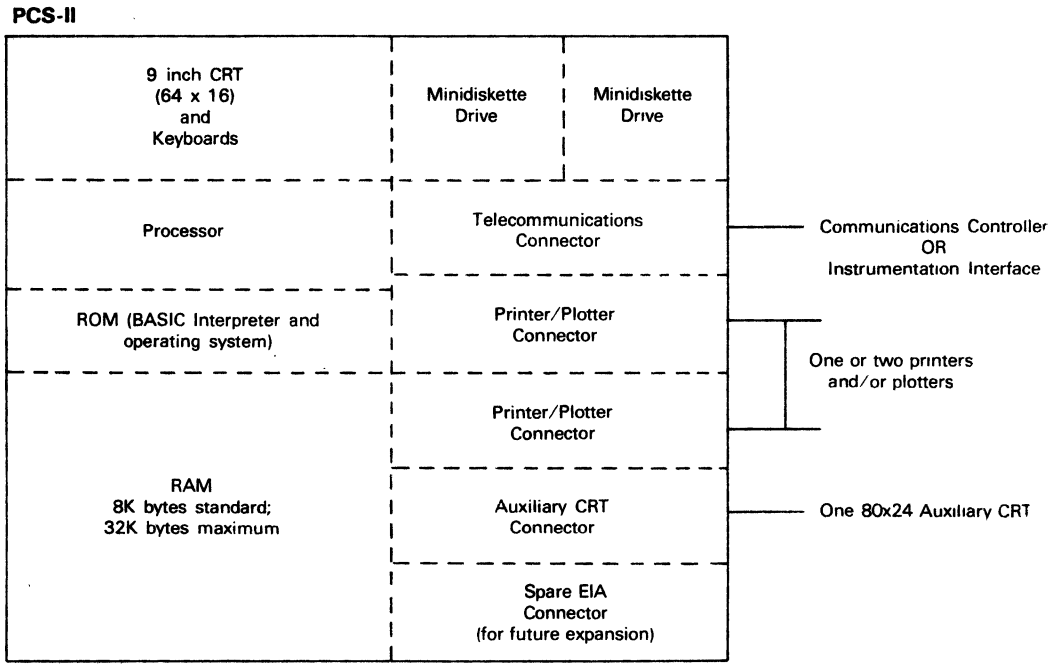
An Auxiliary CRT can be attached to the system. The unit accommodates 24 lines, each line having 80 characters.

KEYBOARD: Consists of a full-typewriter layout, a full numeric pad, mathematical function keys, arithmetic operation keys, 16 shiftable special function and edit keys, a central processor busy light, and an upper/lowercase light. The special function keys are used both for edit functions and for 32 user-defined functions or subroutines for BASIC statement writing. A toggle switch at the left of the keyboard sets the keyboard for alphanumeric entry or BASIC statement (keyword) entry. A keyboard clicker and audio alarm can be optionally attached.

MINIDISKETTE UNIT: One Minidiskette Drive is standard with the PCS-II and a second is optional. Each

Wang Laboratories PCS-II

Configuration



drive accommodates a 5½-inch (13.3 cm) Minidiskette, a reduced version of the original floppy disk. The Minidiskette has 35 tracks, each of which contains 10 sectors of 256 bytes per sector, for a total of 89,600 bytes per diskette. Average access time is 533 milliseconds and the transfer rate is 125K bits per second. The Minidiskette has a write protect notch.

USER MEMORY: The basic system is available with 8K bytes of random access memory and is expandable in either 8K- or 16K-byte increments up to 32K bytes.

PRINTERS AND PLOTTERS: Matrix character printers are available in varying speeds from 110 to 200 characters per second. Line printers are available in speeds of 240, 400, and 600 lines per minute. A bidirectional ball printer with 156 print positions and a speed of 15 characters per second is available. A daisy wheel, 40 character-per-second, bidirectional printer is offered in 132 or 158 positions.

A single-pen or a three-pen plotter is attachable; either unit accepts 16-inch wide paper of unlimited length.

PRICING

The Personal Computing System is available for purchase or on a lease-purchase basis. Wang Leasing, a subsidiary, will provide a 60-month lease-purchase agreement with a monthly charge that is 2.45 percent of the purchase price. A separate maintenance contract is available.

PRICING

The PCS-II is obtainable by purchase for the prices shown in the accompanying table. The terminal is also available on rental or lease plans. Maintenance is included in all rental plans and available separately for leased or purchased equipment. Lease contracts are offered on a full-payout basis only; rental contracts have purchase accruals of 90 percent within the first 90 days from contract execution or 50 percent from the 91st day to the end of the first contract year; thereafter, there are no accruals toward purchase.

Leases can be obtained under the following terms (based on the total purchase price): 24 months, 5%/month; 36 months, 3.6%/month; 60 months, 3.0%/month. Rental contracts, including maintenance, are calculated (based on the total purchase price) as follows: 12 months, 4.5%/month; 24 months, 3.75%/month; 36 months, 3.5%/month; 60 months, 3.0%/month. Maintenance is available for purchased equipment at the rates shown; separate maintenance contracts can be negotiated for preventive maintenance coupled with repair activities, or for repair action only. Without a maintenance contract, service is billed on an hourly basis. At the end of a lease, purchase can be effected under negotiable terms. All PCS-II hardware carries a 90-day warranty.

		Purchase Price	Monthly Maint.
2200-PCS-II-2	Basic PCS-II; 8K bytes	$4,800	$ 50
2200-PCS-II-4	Basic PCS-II; 16K bytes	5,200	60
2200-PCS-II-6	Basic PCS-II; 24K bytes	6,000	70
2200-PCS-II-8	Basic PCS-II; 32K bytes	6,800	80
	Random Access Memory		
	8K-byte Memory Increment	1,300	10
	16K-byte Memory Increment	2,200	20
	24K-byte Memory Increment	3,500	30
	MiniDiskette Drive		
	Additional Minidiskette Drive	1,000	8

Wang Laboratories PCS-II

		Purchase Price	Monthly Maint.
	Telecommunications Options		
OP-62	Asynchronous Communications Controller	750	15
OP-62B	Bisynchronous Communications Controller	1,500	15
OP-67	8-bit Parallel I/O Interface Controller	400	2
OP-65	IEEE-488 Standard Interface	750	4
	Auxiliary CRT		
OP-60	Keyboard Clicker, Audio Alarm, and Auxiliary CRT Connector	100	2
OP-60A	80x24 CRT, Keyboard Clicker, and Audio Alarm	400	5
	Printers/Plotters		
2221W	200 cps Printer, 10 cpi, 132 positions	5,000	56
2231W-1	120 cps Printer, 10 cpi, 112 positions	2,900	28
2231W-2	120 cps Printer, 12 cpi, 132 positions	3,200	28
2295	2231 Printer Stand	250	—
2251	110 cps Printer, 40 positions	1,200	11
2261W	240 lpm Printer	7,000	60
2263-1	400 lpm Printer	14,500	125
2263-2	600 lpm Printer	16,000	138
2281	40 cps Daisy Output Writer	4,500	35
2271	15 cps Selectric Output Writer	3,200	26
2272-1	Single Pen Drum Plotter	2,900	30
2272-2	Three Pen Drum Plotter	3,200	33

Turnkey Systems

	Purchase Price	Monthly Hardware	Maintenance Software
PCS II MINI/CASH; includes PCS-II, 16K bytes, 2nd Diskette Drive, 120 cps Printer, and Auxiliary 80x24 CRT	$14,600	$112	$30
Time/Check II; includes PCS-II, 16K bytes, 120 cps Printer, and Auxiliary 80x24 CRT	13,100	112	20
PCS-II MINI-LIFELINE; includes PCS-II, 8K bytes, 2nd Diskette Drive, 80x24 CRT, and 40 cps Daisy Wheel Printer	16,000	98	30

Wang Laboratories PCS-II

The PCS-II shown above has an independent processor to handle the communications line; two Minidiskette Drives sit atop the display unit. The compact system can function as a terminal or as a data processor.

Programmable display terminal with extensive data processing support.

The basic PCS-II includes a 64x16 Display Unit; up to two Minidiskette Drives with 89,600 bytes of storage each; a microprogrammed processor with up to 32K bytes of semiconductor memory; and a microprogrammed communications controller for handling either teletype, IBM 2741, BSC, or Burroughs Basic Mode protocols.

The PCS-II with 16K bytes of RAM and the BSC Controller can be purchased for $9,800; a maintenance contract would cost $81 per month.

MANAGEMENT SUMMARY

The Personal Computer System has been built on the same processor architecture, the 2200T, that Wang Laboratories successfully included in the 1975 introduction of its WCS series of minicomputer systems.

Wang describes the PCS-II as a hybrid system—half intelligent terminal and half small business computer.

The capability of this compact terminal to function as a small business computer is due to the new Minidiskette Drives. With two Minidiskette Drives, the system has online access to 179,200 bytes of random mass storage contained on easily removable, five-inch, floppy disks.

A separate microprocessor is used for handling the communications interface. This not only makes the function transparent to the user, but also offers operational flexibility beyond that indicated by the interface name. For instance, the Bisynchronous Communications Controller with the BSC program loaded will handle BSC lines, but with the Asynchronous program loaded will handle Teletype or IBM 2741 protocol. Support of other protocols could easily be programmed. The Asynchronous Controller, half the price of the Bisynchronous Controller, cannot support BSC protocol because it does not have sufficient RAM to contain the BSC program.

Since the communications controller microprocessor operates independently of the central processor, data entry can be in progress concurrent with data transmission, given the appropriate software support. Timing and volume consideration of the specific applications would determine the advisability of concurrent operations.

CHARACTERISTICS

VENDOR: Wang Laboratories, Inc., One Industrial Avenue, Lowell, Massachusetts 01851. Telephone (617) 851-4111.

DATE OF ANNOUNCEMENT: March 1977.

DATE OF FIRST DELIVERY: March 1977.

NUMBERED DELIVERED TO DATE: 200.

SERVICED BY: Wang Laboratories, Inc.

CONFIGURATION

The Personal Computer System-II (PCS-II) is a desktop programmable terminal featuring Minidiskette Drives for random access mass storage and an optional, independent microprogrammed communications controller. The latter permits the terminal to emulate the protocols of the IBM 2780, 3780, 3741, and 2741 on a user-transparent basis.

The basic PCS-II includes:

- **A self-contained version of the Wang 2200T processor.**
- **8K bytes of random access memory (RAM).**
- **A read only memory (ROM) coded with the BASIC interpreter and the operating system.**
- **A 9 inch (64x16) CRT.**
- **A keyboard.**
- **One Minidiskette Drive.**
- **A Telecommunications Connector.**
- **Provision for attachment of an Auxiliary CRT.**
- **Two Printer/Plotter Connectors.**
- **A spare connector.**

The Telecommunications Connector can support attachment of the Bisynchronous Communications Controller, the

Wang Laboratories PCS-II

For time critical I/O operations, PCS's BASIC language provides the capability to code such operations in time-efficient, absolute-like code. However, for typical applications, such considerations are user-transparent. For the user employing the terminal for data entry, and not wishing to do his own programming, Wang supplies EASYFORM, a software packge to drive the terminal as a data entry device.

Wang is one of several terminal vendors that offers turnkey systems, hardware and special purpose application software for a single price.□

Asynchronous Communications Controller, the Parallel I/O Controller, or an instrumentation interface. A selection of character and line printers, a single-pen plotter, and a three-pen plotter can be attached to the Printer/Plotter Connectors. One Auxiliary 80x24 CRT can be supported by the Auxiliary CRT connector.

TRANSMISSION SPECIFICATIONS

One of three communications controllers or an instrumentation interface can be attached to the PCS-II Telecommunications Connector.

The Bisynchronous Communications Controller contains its own microprocessor with a 1K ROM and an 8K RAM. With one of three no-cost Wang-supplied software packages, this controller can emulate the BSC protocol of the IBM 2780, 3780, or 3741. Such configurations permit the PCS-II to function as a workstation to an IBM System 360/370 or other BSC-compatible host computer systems. This controller can also be loaded with a program for Burroughs Basic Mode protocol, which supports asynchronous or synchronous, multipoint (poll/select) transmission.

A version of the same microprocessor, with less RAM, is programmed to handle Teletype and IBM 2741 protocols. This Asynchronous Telecommunications Controller is normally used for interactive communications between a host computer and the PCS-II.

Both the Asynchronous and the Bisynchronous Communications Controllers support EIA RS-232C or CCITT V.24 standards and speeds up to 4800 bps.

An 8-bit Parallel I/O Controller is also available.

To attach data collection instrumentation to the PCS-II, the IEEE-488 Standard Interface option is used, which is attached to the PCS-II via the Telecommunications Connector.

SOFTWARE

User programming is normally performed in Wang Extended BASIC. BASIC statements are entered directly through the keyboard and can be run either as entered (immediate mode) or when required (program mode). BASIC statements resident in the RAM are operated upon, or compiled, by the BASIC Interpreter that is permanently resident in the 42.5K-byte ROM along with the operating system. The interpreted instructions are executed by the processor while the next statement is simultaneously being interpreted. BASIC has a repertoire of 132 statements, 99 error codes, and 13 commands. The commands give the user keyboard communication with the Basic Interpreter. BASIC can be commanded to run a program, clear memory, list a program, etc. The user can make up to 32 subroutines of frequently used functions; these can be invoked when writing Program statements by depressing a single function key. Since BASIC does not require one statement per line, a single 192 character line can contain many statements. In addition to the fundamental statements, BASIC provides statements to handle math matrix, trigonometric and algebraic functions, and alphanumeric sorts. One statement gives the programmer the ability to write I/O statements in an also absolute code-like fashion. BASIC will support up to 286 variable names for either simple numeric or alphanumeric variables or arrays. The total number of unique variable names is 1144. An alphanumeric variable can be up to 64 bytes long. The nesting maximum for FOR/NEXT loops and for subroutines is each 45 levels. Arithmetic precision is 13 significant digits. All math functions are performed by a separate floating-point processor.

When using the terminal for data entry, the user can avoid programming altogether by using EASYFORM, a Wang software package. The package facilitates creation of an input prompting form that can be used by the operator when entering data. Up to 10 form layouts, each with up to 50 data fields, can be saved on diskette. Data entered through EASYFORM is stored on disk in the appropriate transmission format.

Wang also markets the PCS-II as part of several turnkey systems that also include the application software. Three such systems are described below.

The PCS-II Patient Billing System performs billing and medical insurance form completion for doctors, dentists, and health services groups. The system can be expanded to perform the related accounts receivable function.

The Time/Check II system performs time analysis of billable time for attorneys, accountants, advertising agencies, architects, and other professionals. The system can also perform the actual billing function and produce customized mass mailings.

The PCS-II Lifeline system produces customized policy proposals for independent life insurance agents. The system can also perform mass mailing of customized letters.

Other software systems include MINICASH, an accountants work-up system; MINI/SPARK, a simplified inventory and warehouse control system for auto parts dealers; AUTOMATE II, an auto dealers finance, insurance and forms filing system; MINI/MPS, a management planning system for budgeting and modeling of forecasts; and MORTGAGE MANAGEMENT, a system to manage and compute residential/commercial mortgages for thrift institutions.

COMPONENTS

DISPLAY UNIT: The console CRT is a 9 inch (22.9 cm) diagonal unit with 16 lines, each accommodating 64 characters (1024 characters total). Character height and width is 0.125 inches (0.32 cm).

An Auxiliary CRT can be attached to the system. The unit accommodates 24 lines, each line having 80 characters.

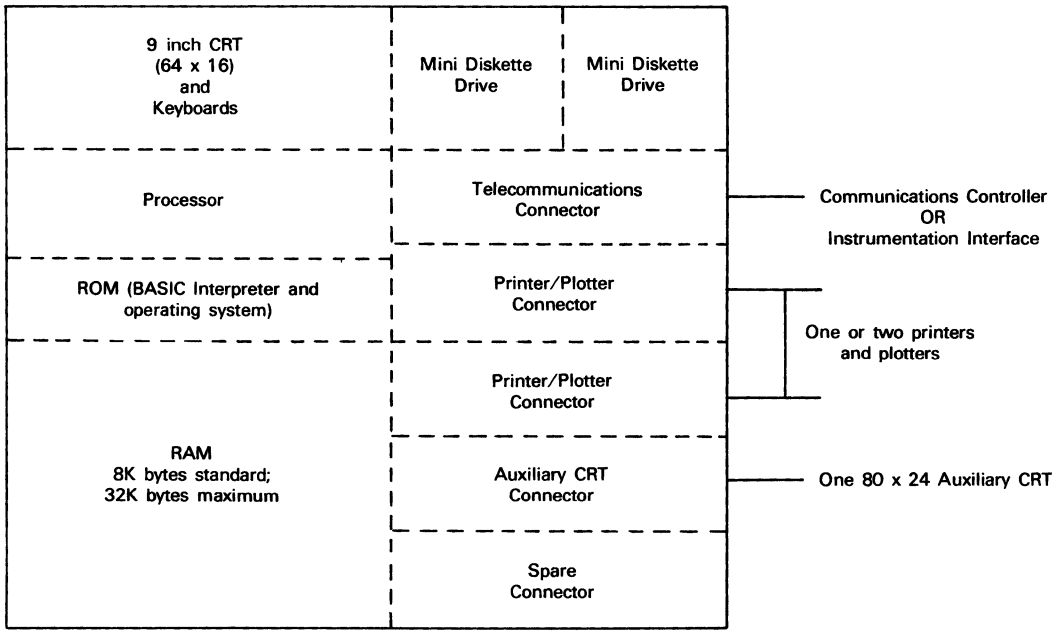
KEYBOARD: Consists of a full-typewriter layout, a full numeric pad, mathematical function keys, arithmetic operation keys, 16 shiftable special function and edit keys, a central processor busy light, and an upper/lowercase light. The special function keys are used both for edit functions and for 32 user-defined functions or subroutines for BASIC statement writing. A toggle switch at the left of the keyboard sets the keyboard for alphanumeric entry or BASIC statement (keyword) entry. A keyboard clicker and audio alarm can be optionally attached.

MINIDISKETTE UNIT: One Minidiskette Drive is standard with the PCS-II and a second is optional. Each

Wang Laboratories PCS-II

Configuration

PCS-II



drive accommodates a 5½-inch (13.3 cm) Minidiskette, a reduced version of the original floppy disk. The Minidiskette has 35 tracks, each of which contains 10 sectors of 256 bytes per sector, for a total of 89,600 bytes per diskette. Average access time is 533 milliseconds and the transfer rate is 125K bits per second. The Minidiskette has a write protect notch.

USER MEMORY: The basic system is available with 8K bytes of random access memory and is expandable in either 8K- or 16K-byte increments up to 32K bytes.

PRINTERS AND PLOTTERS: Matrix character printers are available in varying speeds from 110 to 200 characters per second. Line printers are available in speeds of 240, 400, and 600 lines per minute. A bidirectional ball printer with 156 print positions and a speed of 15 characters per second is available. A daisy wheel, 40 character-per-second, bidirectional printer is offered in 132 or 158 positions.

A single-pen or a three-pen plotter is attachable; either unit accepts 16-inch wide paper of unlimited length.

PRICING

The Personal Computing System is available for purchase or on a lease-purchase basis. Wang Leasing, a subsidiary, will provide a 60-month lease-purchase agreement with a monthly charge that is 2.45 percent of the purchase price. A separate maintenance contract is available.

		Purchase Price	Monthly Maint.
2200-PCS-II-2	Basic PCS-II; 8K bytes	$6,200	$50
2200-PCS-II-4	Basic PCS-II; 16K bytes	7,800	66
2200-PCS-II-6	Basic PCS-II; 24K bytes	9,200	82
2200-PCS-II-8	Basic PCS-II; 32K bytes	10,600	98
	Random Access Memory		
	8K-byte Memory Increment	2,000	16
	16K-byte Memory Increment	3,200	32
	MiniDiskette Drive		
	Additional Minidiskette Drive	1,000	8
	Telecommunications Options		
OP-62	Asynchronous Communications Controller	1,000	15
OP-62B	Bisynchronous Communications Controller	2,000	15
OP-67	8-bit Parallel I/O Interface Controller	400	2
OP-65	IEEE-488 Standard Interface	750	4
	Auxiliary CRT		
OP-60	Keyboard Clicker, Audio Alarm, and Auxiliary CRT Connector	100	2
OP-60A	80x24 CRT, Keyboard Clicker, and Audio Alarm	400	5

Wang Laboratories PCS-II

		Purchase Price	Monthly Maint.
	Printers/Plotters		
2221W	200 cps Printer, 10 cpi, 132 positions	5,000	56
2231W-1	120 cps Printer, 10 cpi, 112 positions	2,900	33
2231W-2	120 cps Printer, 12 cpi, 132 positions	3,800	33
2295	2231 Printer Stand	250	—
2251	110 cps Printer, 40 positions	1,100	11
2261W	240 lpm Printer	7,000	75
2263-1	400 lpm Printer	14,500	125
2263-2	600 lpm Printer	16,000	138
2281	40 cps Daisy Output Writer	3,600	35
2271	15 cps Selectric Output Writer	3,000	30
2272-1	Single Pen Drum Plotter	2,900	30
2272-2	Three Pen Drum Plotter	3,200	33

Turnkey Systems

	Purchase Price	Monthly Hardware	Maintenance Software
PCS-II Patient Billing; includes PCS-II, 16K bytes, 2nd Diskette Drive, Auxiliary 80x24 CRT, 120 cps Printer	$13,400	$112	$25
PCS II MINI/CASH; includes PCS-II, 16K bytes, 2nd Diskette Drive, 120 cps Printer, and Auxiliary 80x24 CRT	16,000	112	30
Time/Check II; includes PCS-II, 16K bytes, 120 cps Printer, and Auxiliary 80x24 CRT	14,500	112	20
PCS-II MINI-LIFELINE; includes PCS-II, 8K bytes, 2nd Diskette Drive, 80x24 CRT, and 40 cps Daisy Wheel Printer	17,480	98	30 ■